City of Burnsville

Sustainability Guide Plan Supplement

- GHG Reduction Goals
- Implementation Priorities
- Baseline Assessment

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City of Burnsville

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Introduction

The City of Burnsville is committed to improving its sustainability. The City has worked to shape private development to create a more walkable city, recognized the community interest in creating a sense of place, made innovative demand-side investments in stormwater infrastructure, developed programs to create value from materials that are typically treated as waste products, and incorporated natural resource systems into private and public development. Over the last the five years, the City adopted plans and policies that guide its sustainability efforts including an environmental end statement, the "Burnsville for the 21st Century Visioning Project" (7/25/06), and the "Sustainability Guide Plan" (Guide Plan, adopted February 2009). The Guide Plan identifies, in the "Greenhouse Gas Reduction" Best Practices area, the following selected implementation actions:

- Establish a greenhouse gas (GHG) emission tracking procedure with annual reporting to gather baseline data.
- Develop a GHG emission reduction strategy based on collected baseline data and establish a reduction goal.

In May 2010, the City began a process of identifying a GHG assessment protocol and identifying criteria for setting reduction goals and strategy priorities. The inventory development process followed the ICLEI-Local Governments for Sustainability program protocols. Following the ICLEI protocols will allow the City to more easily join ICLEI in future years. Based upon the inventory results and a review of existing policy, the City's Sustainability Team set draft reduction goals and strategy priorities for consideration and adoption by the City Council.

This report provides the Sustainability Team's recommendations for GHG reduction goals, policy and implementation priorities, and the GHG inventory results (Appendix 1). The main body of the report identifies the City's greenhouse gas reduction goals, implementation priorities, and suggested strategies for meeting the goals. The detailed GHG inventory results are provided in the appendix.

Using the GHG Inventory

Goal-Setting and Implementation Prioritization Process

The Sustainability Team, comprised of City staff and Department Heads, spent several meetings considering and applying decision criteria for setting GHG reduction goals consistent with the City's sustainability Plan. The Team separately examined data for City operations and community activities and set distinct decision criteria for each sector. The Team then applied the decision criteria to recommend GHG reduction targets for public sector operations. The Sustainability Team also looked at possible reduction targets for the private sector and the broader communmity with the understanding that these targets are advisory only.

After setting GHG reduction targets, the Team considered how to meet the reduction targets. As with the reduction targets, the Team first identified criteria for prioritizing actions that would reduce GHG emissions. The Team then applied the criteria to identify two sets of implementation strategies, one for City operations and one for community activities.

The reduction goals and implementation priorities are presented below. The first section discusses the process and recommendations for City-operations' GHG reduction target and implementation criteria. The second section offers the same for the entire community.

Implementation Activities					
	ACTIVITY/DESCRIPTION	Lead Department	Timeframe	Cost: I = Implementation A = Annual Cost	Potential Benefits
Strategy 1 - Reduce City Greenhouse Gas Emissions					
A	Establish GHG emission tracking procedure with annual reporting to gather baseline data.	Sustainability Coordinator	Initial Plan		
B	Institute a policy of reporting fuel consumption from all city sources as well as expenditures to accounts payable.	Sustainability Coordinator	Short Term	Existing Staff	Understanding of city status and progress
C	Develop GHG Emission reduction strategy based on collected baseline data and establish a reduction goal.	Sustainability Coordinator	Short Term	Existing Staff	Strategy based on local data, Cost savings

Source: Sustainability Guide Plan, P. 19

1. GHG Reduction Goals and Decision Criteria
City of Burnsville Public Sector Operations

Reducing GHG emissions is not an end in itself, but a method of achieving other goals. In determining a City-operations reduction target, the Sustainability Team first discussed standards or goals that should be met by the GHG reduction target. The Team ended by recommending that the GHG reduction target for **public sector** operations should:

1. Emphasize cost effective management of City energy use.
2. Encourage the City to be a leader in efficient management of GHG emissions.
3. Result in a short-term (by 2011) absolute reduction of total GHG emissions from Burnsville's 2009 GHG measurement.
4. Make continual progress over time toward the GHG reduction goals of Minnesota Next Generation Energy Act of 2007.

> *"Burnsville will strive to inventory and set reduction targets for greenhouse gas emissions for city facilities."*
>
> Sustainability Guide Plan, Sustainability Best Practice 3, Greenhouse Gas Reduction

> *"Develop GHG Emission reduction strategy based on collected baseline data and establish a reduction goal."*
>
> Sustainability Guide Plan, Strategy 1C

Setting the reduction target

The above four standards are in order of priority and in ascending order in regard to the final numerical reduction target. In other words, the top priority (cost effective management), taken by itself, would likely result in a less aggressive reduction goal than the 3rd or 4th priority. In all cases, the City's annual budget process will be the overriding factor that determines whether an action is implemented in any given year or not. Based on these priorities, the Sustainability Team recommends a reduction goal and implementation criteria for prioritizing GHG reduction actions that address all four priorities in the following manner:

GHG Reduction Target - Between 2005, the City's GHG baseline, and 2009, GHG emissions from City operations increased by 5%, or an average of 1.2% per year. The Sustainability Team recommends the following GHG reduction target. As measured from the 2009 emission level of 23,487 tonnes, the City of Burnsville will reduce GHG emissions associated with City operations to below 2009 levels by the end of 2011. Recognizing Burnsville's Next Generation Energy Act obligations, the City will continue to reduce emissions from the baseline by an average annual reduction of 4% (measured over the span of a decade), after indexing emissions to growth in number of City employees relative to the rest of the State.

The 4% average annual reduction is measured over the span of a decade to account for GHG reduction efforts that are infrastructural, taking time to ramp up over time. The goal is indexed to the number of City employees relative to the rest of the State to recognize that the Next Generation Act goal is statewide, and cit-

> **Next Generation Energy Act**
>
> This law passed by the Minnesota Legislature in 2007 and signed by Governor Tim Pawlenty aims to bolster investments in renewable power, increase energy conservation and decrease Minnesota's contribution to global warming. Among its provisions, it established overall energy policy goals for the state of Minnesota that:
>
> (1) The per capita use of fossil fuel as an energy input be reduced by 15 percent by the year 2015, through increased reliance on energy efficiency and renewable energy alternatives;
>
> (2) 25 percent of the total energy used in the state be derived from renewable energy resources by the year 2025; and
>
> (3) The state's greenhouse gas emissions be reduced to 15 percent below 2005 base levels by 2015, 30 percent by 2025 and 80 percent by 2050.
>
> *Source: NextStep, www.nextstep.state.mn.us/*

ies such as Burnsville are likely to see greater economic growth and a consequent need for new services than many other parts of the State.

Prioritizing GHG Reduction Actions

To meet the reduction target, the City should prioritize GHG reduction actions using the following four criteria, in descending order of consideration:

1. Lifecycle cost effectiveness (highest economic return over the lifetime of the action)
2. Greatest GHG reduction effectiveness (lowest cost per ton of GHG reduction)
3. Impacts on quality of life or quality of service (affecting comfort or service quality)
4. Impacts on other sustainability goals (water quality, natural resource protection, waste reduction, community health, etc).

Lifecycle cost effectiveness. Evaluating lifecycle cost effectiveness will allow actions to be placed into one of three categories for prioritization: 1) actions that pay for themselves in energy savings; 2) actions that generate cost savings for the City, but not sufficient to pay the full cost of the measure; and, 3) actions that reduce GHG emissions but increase costs for the City.

Top priority will be given to actions that both reduce GHG emissions and are cost effective, with highest priority given to actions that have the best lifecycle cost.

Actions that fall into the remaining two lifecycle cost categories, will be undertaken after all cost effective measures are completed and the numerical targets are still not met. In such a case, actions that are not cost-effective will be prioritized by the GHG reduction effectiveness (lowest $/ton CO_2).

The Sustainability Team determined that the final criteria for prioritizing actions are the effects of actions on the quality of City services, the effects on residents' or employees' quality of life, and the synergy or conflict between the GHG reduction actions and other sustainability goals.

Applying the Priorities

Selecting Strategies

The City has a broad range of strategies in its implementation portfolio that can move the City toward achieving its City operations GHG reduction goal. Applying the prioritization criteria, the City will first implement those actions that are cost effective over the lifecycle of the action. Most GHG emission reduction strategies that show lifecycle cost effectiveness are those that reduce

Life-Cycle Costs

Life-cycle cost analysis (LCCA) is an economic method of project evaluation in which all costs arising from owning, operating, maintaining, and disposing of a project are considered important to the decision. LCCA can be applied to any capital investment decision, and is particularly relevant when high initial costs are traded for reduced future cost obligations.

Section 707 of Executive Order 13123 defines life-cycle costs as "…the sum of present values of investment costs, capital costs, installation costs, energy costs, operating costs, maintenance costs, and disposal costs over the lifetime of the project, product, or measure."

Source: Guidance on Life-Cycle Cost Analysis Required by Executive Order 13123, 2003

Lifecycle Cost Categories

Cost Effective – An investment or practice that over its lifetime saves the City more dollars than the total cost (capital and maintenance) of the investment or practice.

Generates Cost Savings – An investment or practice that reduces the City's costs, but does not reduce costs more than the lifecycle cost of the investment or practice.

Increases Costs – An investment or practice that does not generate cost savings for the City, but provides other benefits.

Energy Efficiency Strategies

Most energy efficiency investments will both reduce GHG emissions and reduce utility bills and other City costs sufficiently to pay for the costs of implementation. Installing LED signal lights, a measure that the City has largely already completed, creates both energy cost savings and saves on labor costs due to the long life of the LEDs relatively to conventional technology.

energy consumption, either through improved efficiency or by generating on-site power or heat to reduce utility costs. Actions that have the best lifecycle cost will be assigned a high priority.

Cost effective actions may be sufficient to allow the City to meet its GHG reduction goals. As these actions ultimately create an economic benefit for the City, in such a case the City can meet all (or a substantial portion of) its GHG emission reduction goal while reducing costs.

Other Strategies

If the City implements those initiatives that are cost-effective and still does not meet its GHG reduction goal, the City should consider implementing other strategies. However, many of these strategies still provide cost savings or other benefits in addition to reducing GHG emissions. The City will prioritize these other (non-cost-effective) strategies on the basis of cost per metric ton of GHG emissions avoided (dollars/tonne).

The City already chooses to implement some of these types of actions for reasons other than creating cost savings. For instance, instituting recycling within City buildings and operations generates some savings, but generally costs more than it saves. Recycling is, however, done regardless in order to help the City meet solid waste reduction goals. These strategies can also reduce GHG emissions.

Other Strategies – Dakota County Example

Dakota County estimates, in its GHG emissions reduction report, that increasing employee recycling 15% will cost less than $10,000 and reduce GHG emissions at a cost of $312.50 per tonne. Another strategy, subsidizing 2% of county employees to use transit, would cost slightly more, $13,000, but considerably more ($530/tonne) on a cost per tonne basis.

Simplified Step-by-Step Guide to Using Prioritization Criteria

1. **Assess lifecycle cost and GHG emission reduction effectiveness.** Assemble a list of potential strategies and assess the strategies for cost effectiveness and GHG reductions. Energy audits can identify both cost effectiveness and GHG reductions. The Climate & Air Pollution Planning Assistant spreadsheet produced by the ICLEI-Local Governments for Sustainability program can also provide a good indicator for a wide range of strategies (see website at www.icleiusa.org/cappa). CAPPA will provide an indicator both cost effectiveness and GHG emission reduction effectiveness.
2. **Implement strategies that are cost-effective.** Select those strategies with the greatest cost-effectiveness, and calculate the total GHG emission reductions. Implement all cost-effective strategies, starting with the most cost-effective.
3. **Implement other strategies.** If the reduction goal has not been met after implementing cost-effective strategies, start implementing other strategies that have the lowest cost per ton of CO reduction ($/ton CO2). The prioritization should take into consideration criteria 3 and 4, (quality of life impacts and synergy with other City goals) which may result in changing priorities.
4. **Reassess overall City emissions.** The GHG reduction goal is to reduce total GHG emissions from City operations. While the GHG reduction strategies will lower the City's GHG emissions, other factors will increase GHG emissions. Adding new vehicles and buildings, expanding hours of operation, increased demand for City services and utilities, all put upward pressure on the total GHG emissions. The City needs to reassess its total emissions every two years to measure actual progress.

Coordination with the Sustainability Guide Plan

A review of the City's Sustainability Guide Plan revealed that it identifies 39 best practices that could help reduce the city's GHG emissions.

These actions do not comprise the universe of GHG reduction actions, but are the actions already recommended in the Council-approved Sustainability Guide Plan. The Sustainability Team considered the 39 Guide Plan best practices to identify the status of each best practice. These actions should be evaluated against the four action criteria and assigned priorities based on cost and GHG-reduction effectiveness.

City Facility Best Practices likely to reduce GHG emissions
City of Burnsville Sustainability Guide Plan

Green – Completed
Yellow – Ongoing
Blue – To be evaluated using GHG reduction implementation criteria
Red – Set aside or rejected

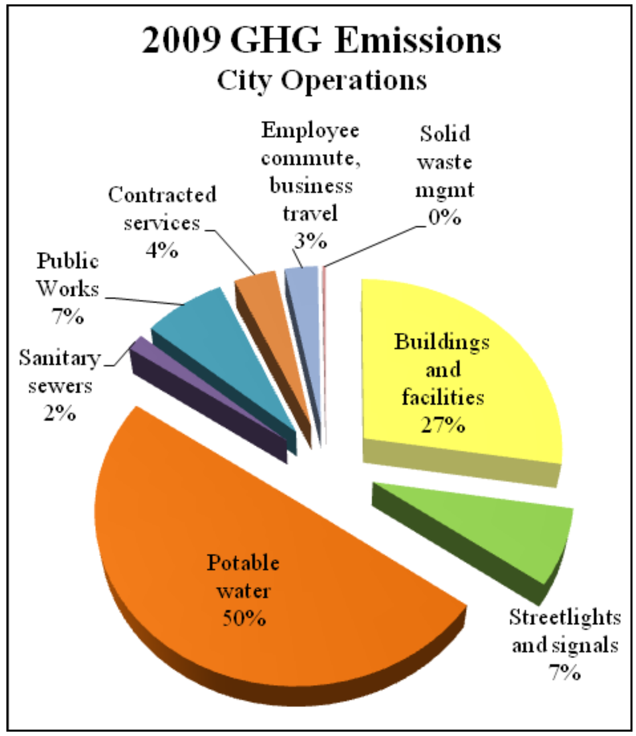
	Best practice	Status
1.	Recycle existing roadway structure for street reconstruction projects	Completed (ongoing)
2.	Utilize sustainable construction techniques: Investigate the use of alternative materials and practices.	Green Building Guide Completed
3.	Implement recommendations of City Hall Energy Audit (retrofit lighting).	Completed – Retrofit Lighting
4.	Participate in Dakota Electric's Energy Audit Program for the remaining city facilities to identify opportunities for energy savings.	Completed – all major buildings audited
5.	Implement recommendations of City Hall Energy Audit (Improve HVAC Control Upgrades, Rebalance Air Systems, and Upgrade Building Automation System).	Completed – systems upgraded
6.	Explore a geothermal system in the ice arena.	Completed - system installed
7.	Standardize Recycling Containers and signage.	Completed
8.	Conduct Employee orientation/ongoing recycling training.	Completed – process ongoing
9.	Select a city building/property (e.g. Ice Center) a city model of sustainability.	Completed – Ice Center, Civic Center
10.	Consider instituting policies to reduce trips generated by City employees: Explore flex time and telecommuting policies.	Partially completed
11.	Work with School District to examine transportation policy: Busing policy changes; Promote carpooling, bicycling walking.	Ongoing – Safe Routes to School
12.	Cautiously continue with incorporating flex fuel in City fleet.	Partially complete
13.	Implement recommendations of City Hall Energy Audit (Upgrade to Condensing Boiler upon failure of existing).	Scheduled but not completed
14.	Establish roof replacement and energy efficiency improvement timeline for city facilities. Consider installing photovoltaic roofing when appropriate.	Ongoing
15.	Improve public space recycling.	Ongoing
16.	Implement the Urban Forestry components of the Natural Resource Master Plan (NRMP).	Ongoing
17.	Increase the ratio of overstory trees to smaller trees in city parks.	Ongoing – targeted areas
18.	Consider the use of hybrid technologies, plug-in hybrids.	Hybrid purchases, no plug-ins

19.	Continue to replace and improve electrical equipment with more efficient equipment in the water production facilities.	Apply GHG implementation criteria
20.	Establish city policy to purchase energy efficient fixtures.	Apply GHG implementation criteria
21.	Establish city policy to evaluate all city renovation projects for sustainable opportunities.	Apply GHG implementation criteria
22.	Establish energy and water use targets for city buildings.	Apply GHG implementation criteria
23.	Transit promotion: Web promotions; Work with MVTA to provide coupons.	Apply GHG implementation criteria
24.	Consider hybrid medium duty chassis for larger vehicles.	Apply GHG implementation criteria
25.	Utilize the B3 Benchmarking Database for all city buildings to evaluate buildings performance and direct resources accordingly.	Apply GHG implementation criteria
26.	Establish a timeline for training city employees in B3 (Buildings, Benchmarks and Beyond) or LEED.	Apply GHG implementation criteria
27.	Develop standardized site selection and building design process for city buildings.	Apply GHG implementation criteria
28.	Investigate participation in the Dakota Electric Wellspring Wind Energy Program.	Apply GHG implementation criteria
29.	Investigate installing a solar thermal domestic hot water system in City Hall.	Apply GHG implementation criteria
30.	Consider passive solar principles to THE GARAGE expansion.	Apply GHG implementation criteria
31.	Explore installing a demonstration PV system as part of an expansion of THE GARAGE.	Apply GHG implementation criteria
32.	Evaluate and track carbon storage capacity of city's forests.	Apply GHG implementation criteria
33.	Implement Boulevard Tree Planting Permit Program for residents	Apply GHG implementation criteria
34.	Conduct a water use audit and install conservation equipment in city owned facilities.	Apply GHG implementation criteria
35.	Explore the installation of solar energy systems in City facilities.	Explored, not yet cost effective. Consider after cost effective practices implemented
36.	Explore the incorporation of a geothermal system into City facilities.	Explored, not cost effective, consider after cost effective practices implemented
37.	Explore option of using a private waste hauler to provide recycling in the parks.	Explored, but not adopted
38.	Consider implementation of the Minnesota Municipal Energy Challenge.	More information needed
39.	Participate in Great River Energy's new construction program encouraging LEED and the energy performance requirements of the Sustainability Building 2030 standards.	More information needed

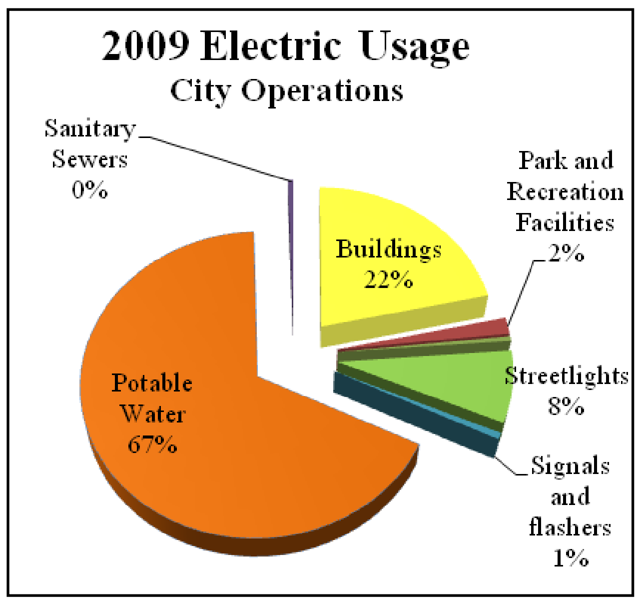
Implementation Priorities – Water System

Burnsville's water utility operations are the primary source of GHG emissions for City operations. Over half of the total GHG emissions come from energy use in the water utility. The water utility accounts for over 60% of the City's total electric use.

Burnsville's *Sustainability Guide Plan* identifies a number of implementation priorities that relate to the water utility sector of city operations. For instance, under the Energy Efficiency best practice area, Implementation Strategy 1H is "Continue to replace and improve electrical equipment with more efficient equipment in the water production facilities." In the Surface and Groundwater Resources best practice area, Implementation Strategies 2B through 2G relate to water use efficiency by end users.



Electricity use for pumping water from the City's wells and the quarry, and pumping from the reservoir into the distribution system are main source of the City's GHG emissions. Some additional electric use is also attributable to water treatment and to lighting and cooling buildings. The system also uses natural gas fired pumps, although the energy use and GHG emissions for these uses are significantly smaller than the electric pumps.



In order to meet the City's GHG reduction goals, the City will need to address energy usage and GHG emissions in the City's drinking water system. Two strategies that are consistent with the Sustainability Guide Plan are described below within the context of the four criteria for prioritizing GHG reduction actions.

1. Lifecycle cost effectiveness
2. Greatest GHG reduction effectiveness
3. Impacts on quality of life or quality of service
4. Impacts on other sustainability goals

Strategy 1 - Consider pumping efficiency improvements to water utility operations.

The City has 17 wells each with its own pump and six large pumps for the aquifers and quarry pumping. Of these, the 15 electric pumps account for most of the electric use, and GHG emissions, in the water utility. Some of these pumps are fairly new, efficient units. Others have not been replaced for a considerable time, and are likely to be quite inefficient relative to a high efficiency new pump. Furthermore, very few of the pumps (all but two) are not submersible, but are above ground and requiring buildings to house them. Submersible pumps are not only more efficient, but generally require less maintenance and do not need to be housed in a building (as they are located within the well itself).

Pumps are serviced and rebuilt on a set schedule. Accelerating scheduled maintenance and moving to pump replacement rather than rewinding or other maintenance to the existing pump is a potentially cost effective strategy with substantial GHG emission reductions. Replacing existing pumps with submersible pumps would likely be a larger expense, but could result in even more substantial cost savings in pumping energy costs plus reduction in forward-looking maintenance costs. Additional cost savings can be realized as the pump buildings would no longer need to be air conditioned to remove heat. If buildings can be ultimately removed, the City would not need to replace roofs, paint, or conduct other building maintenance.

This strategy appears to perform well with the four criteria for priorities GHG reduction actions:

1. *Lifecycle cost effectiveness.* The strategy is likely to show a positive lifecycle cost effectiveness (although more analysis is needed);
2. *GHG reduction cost effectiveness.* The strategy could have significant impacts on City operations' GHG emissions both in short and long term;
3. *Quality of life or service.* The strategy should ultimately reduce maintenance obligations of City staff without any impact on the quality of service provided to customers.
4. *Effects on other sustainability goals.* The strategy does not have significant implications for other sustainability goals, other than providing for a more fiscally sustainable water system.

Strategy 2 - Consider demand-side initiatives that will lower the high peak water demand.

Approximately half the water pumped by the City's water utility is used for irrigation of lawns (residential and commercial). Summer water usage, from May through September, is the most expensive water to pump, requiring use of deeper wells and less efficient pumping systems. Several options exist for reducing the amount of water used by residents and businesses during the high cost months.

Demand-side initiatives work to change demand for and usage of water in both the public and the private sector. Such measures may not be considered strictly an issue of city operations. In the case of a city-owned utility, however, setting a clear line between city and private sector operations is problematic; the direct tie between the demand for service and the costs and emissions borne by the City means that both supply and demand initiatives need to be considered.

Several of the following demand-side options are already included in the City's Sustainability Guide Plan under Best Practice area 13, Surface and Groundwater Resources.

a. Restructuring the City's lawn watering regulations to limit irrigation use in the high cost time periods;
b. Use rain sensors on city and private sprinkler systems;
c. Restructuring the water rate schedule to discourage unnecessary irrigation
d. Encourage or incentivize landscaping that does not need irrigation;
e. Improve capture of stormwater for infiltration.

Demand-side strategies with the four criteria for priorities GHG reduction actions:

1. *Lifecycle cost effectiveness.* The strategy is likely to show a positive lifecycle cost effectiveness. The costs of these demand-side initiatives is relatively small (although more analysis is needed). Consideration needs to be given to whether water utility rates fully cover the cost of the most expensive water supply.

2. *GHG reduction cost effectiveness.* Reducing water usage will have a direct impact on GHG emissions by reducing pumping costs. The GHG cost effectiveness is likely to be very high.
3. *Quality of life or service.* Some of these demand-side efforts could have some quality of life implications; irrigating limitations are frequently blamed for unattractive brown lawns, and rate schedule changes will result in some protest.
4. *Effects on other sustainability goals.* The strategy could have substantial synergy with other sustainability goals, as noted in the Sustainability Guide Plan in Best Practice Area 13. Surface water and groundwater sustainability is improved by the kind of measures described above.

2. GHG Reduction Goals and Decision Criteria

Community-Wide Reduction Goals

Making City operations more efficient and sustainable both provides leadership on GHG reduction efforts and provides tangible reductions in the overall community. But City operations currently only account for 2% of the City's overall GHG emissions. Consequently, the Sustainability Team examined the community-wide GHG inventory for opportunities to encourage the overall reduction of GHG emissions. The Sustainability Team emphasized the importance of educational, non-regulatory, opportunites and determined that the GHG reduction target for community-wide emissions should:

1. Emphasize cost effective management of energy use within both the public and private sector.
2. Encourage businesses and residents to follow the City's leadership in efficient management of GHG emissions.
3. Make continual progress toward the GHG reduction goals of Minnesota Next Generation Energy Act of 2007.

Setting the reduction target

The above three standards are in ascending order in regard to the numerical reduction target. In other words, the first standard, taken by itself, would likely result in a less aggressive reduction goal than the 3rd standard. The Sustainability Team recommends a reduction goal and criteria for prioritizing GHG reduction actions that address all three standards in the following manner:

GHG Reduction Goal - Burnsville has seen an 12% weather normalized reduction of community-wide GHG emissions between 2005 and 2009. The City will strive to continue this trend from the 2005 base year emissions of 1,264,964 metric tonnes. The City of Burnsville sets a community-wide GHG reduction goal of 4% by 2015. Beyond 2015, Burnsville will work with State, County, and utility partners to continue to contribute toward the State of Minnesota's Next Generation Energy Act commitments.

Prioritizing GHG Reduction Actions – The Sustainability Team evaluated criteria for the kinds of private sector actions that the City should encourage to reduce community-wide GHG emissions. Actions that meet multiple criteria would be considered a higher priority when the City evaluates its own portfolio of strategies. The most important private sector actions:

1. *Have an economic payback*. Actions that ultimately pay for themselves in cost savings have both a GHG reduction value and an economic value that benefits the resident or business and the community at large.

> *"While it is important to reduce energy use in city buildings it is equally important to educate businesses and residents about the importance of reducing their own energy use. . . Creating strategic partnerships with business to educate business owners on energy efficiency and conservation is another important way to reduce the city's carbon footprint."*
>
> Sustainability Guide Plan,
> Best Practice 7, Energy Efficiency

> *"Encourage residents to reduce their carbon footprint."*
>
> Sustainability Guide Plan,
> Best Practice 7, Strategy 2A

> *"Create strategic partnerships with businesses to educate owners on the benefits of energy efficiency and conservation."*
>
> Sustainability Guide Plan,
> Best Practice 7, Strategy 2B

2. *Have an existing incentive or program administered by others.* Many actions that will help meet community-wide GHG reduction goals are already being encouraged through incentive programs administered by utilities, other units of government, or non-profit organizations. The City can leverage these incentives to achieve its goals.
3. *Meet multiple goals of the City, in addition to GHG reduction.* Actions that meet multiple City goals provide more benefit to the City. Reducing emissions and improving health outcomes or improving surface water quality is better than just reducing emissions.
4. *Have the greatest GHG reduction.* Some actions have big GHG reduction value, some are relatively small. Similarly, some actions create GHG reductions over a very long time, some create GHG reductions only for a short time. Focusing on actions that have large total GHG reduction benefits will help the City meet long-term reduction goals.

> *"Research conducted for the Governor's Climate Change Advisory Group in Minnesota indicated that reducing subsidies for driving and promoting travel alternatives are key to reducing drive alone trips and thus reducing air pollutants and traffic congestion. Abundant subsidized parking at worksites results in higher drive alone rates than one finds at worksites that provide transit, bicycling, or carpool options."*
>
> Sustainability Guide Plan,
> Best Practice 5, Strategy 2

Prioritizing City Strategies

The City has a number of tools and strategies that it currently uses to encourage private sector actions that are consistent with City goals. These tools and strategies fit into the following broad categories:

- education and communications strategies,
- incentive-based strategies
- regulation
- public investment

These tools are also available for helping the City meet its community-wide GHG reduction goal. The Sustainability Team evaluated these categories of tools for the purpose of recommending a portfolio of tools to help the City meet its community-wide GHG reduction goals. The following priorities are in rank order for implementation by the City.

1. *Education* - Create City administered education efforts and related programs to help residents and businesses take GHG reduction actions.
2. *Incentives* - Promote existing incentives, such as the utility energy efficiency programs, to increase the number of businesses taking GHG reduction actions.
3. *Communications* - Collaborate with private industry to identify a need or a desire to create additional energy efficiency opportunities.

Tool Categories for Encouraging Private Sector Action

Education and Communication

- ✓ The City develops a promotional program describing ways for residents and businesses to help the City meet its GHG reduction goals.

Incentive

- ✓ The City co-promotes utility energy efficiency programs to increase the number of businesses participating in the programs.

Regulation

- ✓ The City modifies existing requirements to ensure more pedestrian connections both internally and externally within major subdivisions or redevelopments.
- ✓ The City modifies existing standards to increase the allowed density or FAR in a commonly used zoning district.
- ✓ The City creates new regulation that requires new buildings that are publicly subsidized (TIF, bonding, publicly funded infrastructure) to be certified under a 3rd party energy efficiency standard (Energy Star, GreenStar, LEED, etc).

Public Investment

- ✓ The City builds bicycle trails between neighborhood and between neighborhoods and destinations (commercial areas, schools, etc.).

4. *Public investment* - Make infrastructure investments that can change or enhance private actions that reduces GHG emissions.
5. *Regulation* - Modify existing City regulations to better address GHG emissions.

Coordination with the Sustainability Guide Plan

The City's overall sustainability goals cannot be met merely by making City operations more sustainable; the City's efforts must ultimately leverage action by Burnsville's residents, businesses, and visitors. The City's Sustainability Guide Plan acknowledges this by including a number of goals, policies, and strategies directed to changing private sector actions. Many of the Guide Plan policies and strategies will similarly help the City achieve its GHG reduction goals.

A complete listing of the Guide Plan recommendations that can affect community-wide GHG emission would take many pages. A sampling of potentially significant actions is shown below.

Community Best Practices likely to reduce Community GHG emissions
City of Burnsville Sustainability Guide Plan

Best practices and Strategies		
Best Practice #1 – Environmentally Preferred Purchasing		
1.	Strategy 2A	Encourage EPP for residents by offering "green" tips and promoting campaigns such as Change a light, Change the world; MN Energy Challenge, etc.
2.	Strategy 2B	Share EPP vendors/information with the public through website.
3.	Strategy 2B	Expand the ARROW (Awards for the Reduction and Recycling of Waste) Program to include an awards event, provide information on cooperative purchasing opportunities.
Best Practice #4 – Sustainable Land Use		
4.	Strategy 1A	Provide facilitated, onsite, sustainable land use workshops (and/or training refresher courses) for those in City Hall who deal with land use issues, including pertinent city staff, appointed commissions, and the City Council.
5.	Strategy 1G	Develop and implement sustainability protocols relating to land use decisions.
6.	Strategy 4A	Promote development and redevelopment that efficiently utilizes land, resources and energy. . . .
7.	Strategy 4B	Encourage infill development, redevelopment of brownfield sites, and combination of underutilized parcels.
Best Practice #5 – Sustainable Transportation		
8.	Strategy 1B	Improve transit infrastructure: Make shelters and bus stop locations more appealing for users; Provide facilities for bike parking; Improve bike/ped connections to transit locations.
9.	Strategy 1C	Ensure good transit service to and within new high density developments.
10.	Strategy 2B	Consider developing Travel Demand Management Control Practices.
11.	Strategy 3A	Examine opportunities for Safe Routes to School.
Best Practice #6 – Renewable Energy		
12.	Strategy 1D	Consider funding mechanisms to encourage residents to install renewable energy systems (e.g. low interest loans, assessing cost to property taxes, etc).
13.	Strategy 1G	Encourage proper solar orientation and passive solar construction.
14.	Strategy 3C	Promote use of geothermal systems among businesses, residents and community groups, in particular in the Minnesota River Quadrant.
15.	Strategy 4B	Consider completing a wind speed study in Burnsville.

Best Practice #7 – Energy Efficiency		
16.	Strategy 2A	Encourage residents to reduce their carbon footprint: promote the Minnesota Energy Challenge, provide energy workshops, develop utility bill stuffers and newsletter articles
17.	Strategy 2B	Create strategic partnerships with businesses to educate owners on the benefits of energy efficiency and conservation. Use the ARROW Program for Promotion of energy efficiency.
Best Practice #8 – Sustainable Building Practices		
18.	Strategy 1E	Establish building product guidelines and guidelines for identifying sustainable opportunities on commercial and residential renovations and new construction.
19.	Strategy 3C	Consider non-monetary incentives to encourage green building.
Best Practice #9 – Community Health		
20.	Strategy 2B	Construct new trails that fill in gaps in the existing system and connect to major destinations. Utilize the trail Master Plan as the guide.
21.	Strategy 2D	Make corridor design changes as necessary to provide adequate trail width and separation, safety from motorized traffic; obtain rights-of-way as necessary.
Best Practice #10 – Recycling and Waste Reduction		
22.	Strategy 2A	Expand the residential source separated organics collection program to the entire city.
Best Practice #12 - Healthy Urban Forest		
23.	Strategy 1C	Evaluate and track carbon storage capacity of city's forests.
Best Practice #13 – Surface and Groundwater Resources		
24.	Strategy 2F	Cost-share for water use audits for businesses and residents.
25.	Strategy 2G	Review existing water utility rate structure.

Implementation Priorities – Community GHG Reduction Strategies

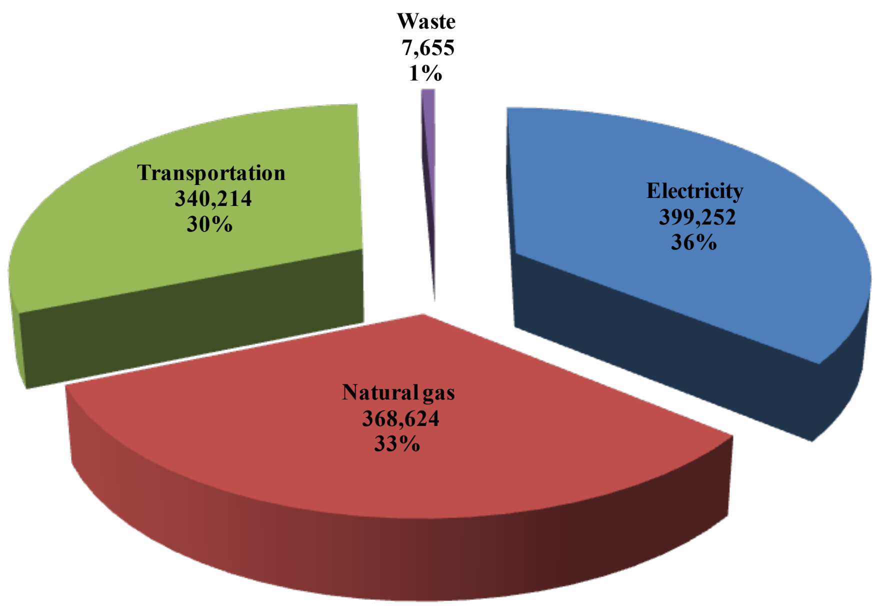
Community-wide GHG emissions are fairly evenly distributed between electric, natural gas, and transportation fuels. Unlike the City GHG emissions which had a clear primary source (water pumping for drinking water system), community emissions are decentralized across households, businesses, and individual vehicles. The implementation priorities, however, do provide some direction for what the City should target in meeting its community-wide GHG reduction goals.

The City uses four energy utilities (three electric and one natural gas) for providing electricity and natural gas to residents and businesses. All four utilities offer energy efficiency incentives to their customers. Furthermore, all of the energy efficiency programs have been evaluated for cost-effectiveness by the Minnesota Department of Commerce within each utility's Conservation Improvement Program hearing.

The City's first and second implementation priorities for community-wide GHG emission reduction actions are:

1. Target actions that have an economic payback;
2. Target actions that have an existing incentive or program administered by others.

Community-Wide Greenhouse Gas Emissions 2009, In Metric Tons



Thus, working to improve the participation rate of residents and businesses in utility energy efficiency programs provides a clear starting place for community-wide GHG reduction initiatives.

Strategy 1 - Co-Promote Existing Incentive and Program for Energy Efficiency

Of the four energy utilities, two provide most of the energy services in the City: Centerpoint Energy is the sole natural gas company; and Dakota Electric Association, provides approximately 70% of the electric energy. Both utilities have energy efficiency rebates and promotional programs directed to both residential and business customers. Dakota Electric residential customers, for instance, have incentive programs providing rebates for purchase of energy using equipment that meets high efficiency standards:

- Energy Star Appliances (refrigerators, freezers)
- Efficient lighting
- Efficient air conditioners and heat pumps

Furthermore, Dakota Electric offers reduced rates for heat pumps and for demand-control of air conditioning and pool heaters. The utility is working with its energy supplier (Great River Energy) on programs for plug-in hybrid cars and renewable energy.

Centerpoint Energy similarly provides energy audits for residences and a number of rebates for efficient equipment. Rebate programs currently include:

- Heating system rebates
- Water heater rebates
- Building envelope (air sealing and insulation) rebates

Xcel Energy provides approximately 25% of the electric energy in the City, and has similar programs to those noted here.

Co-promotion of energy efficiency programs has been shown to be an effective way for local governments to increase participation by residents and businesses. Possible program concepts include:

- Adapting techniques used by the City to promote recycling to energy efficiency;
- Direct co-promotion of utility programs through City mailings or other outreach;
- Creating neighborhood competitions to sign up the most residents, with some recognition by the City for the winners
- Press conferences, awards, or similar recognition for businesses that reduce energy use through utility programs.

The Burnsville Sustainability Guide Plan includes program concepts similar to the concepts outlined above. The GreenStep Cities best practices also include actions for co-promotion of energy efficiency programs, as does the Local Governments for Sustainability CAPPA database. Cost effectiveness for such campaigns or co-promotions usually look very good, although measuring real results are somewhat difficult.

Strategy 2 - Encourage Private Sector Renewable Energy Incentives

Similar co-promotion or marketing efforts can be used for promoting renewable energy incentive programs that are offered by utilities, the State of Minnesota, and the Federal government. All forms of energy generation have much lower cost-effectiveness than energy efficiency, but many businesses and residents are interested in on-site generation of renewable energy for reasons other than energy payback, and such private sector investment will help meet community-wide GHG goals.

Strategy 3 - Create Alternative Transportation Infrastructure

Facilitating changes in transportation options and choices are a longer term initiative, but absolutely necessary to continue to meet Burnsville's GHG reduction goals. Strategies for reducing community-wide transportation GHG emissions that are consistent with the community-wide GHG reduction implementation priorities include:

- Continued expansion of Burnsville's trail system and consider incorporation of "Complete Streets" concepts in street standards and road reconstruction efforts;
- Continued efforts to expand transit options for residents, particularly in those areas identified as higher density for housing or jobs, and along transportation corridors used by commuters;
- Working with employers on travel demand management efforts and programs
- Increase incorporation of mixed use development concepts in the City's redevelopment and development efforts.

Additional Best Practices and Strategies to Consider

ICLEI Local Governments for Sustainability

The ICLEI (Local Governments for Sustainability) program provides a valuable tool for choosing and assessing actions that can help cities meet GHG reduction goals. The Climate and Air Pollution Planning Assistant (CAPPA) spreadsheet has an extensive database of actions for local governments to reduce GHG emissions, along with estimates of costs, savings, and effectiveness. The costs and savings are estimates and will not accurately identify the savings of such programs in Burnsville, but can provide a valuable means of comparing the potential savings across different strategies.

The spreadsheet allows a city to select a preferred category of actions, such as "transportation," identify a transportation subcategory such as "trip reduction" actions, and then select from a list of specific actions to see the specific benefits associated with that action.

ICLEI Local Governments for Sustainability is a membership-based program, although the CAPPA spreadsheet is available free of charge for reference purposes. Technical assistance on CAPPA and on GHG baseline tracking software comes with membership.

Minnesota GreenStep Cities Program

Minnesota GreenStep Cities is an initiative developed to assist Minnesota cities identify a clear path to improved sustainability. The program offers best practices in five distinct categories of sustainability actions: Buildings and Lighting, Transportation, Land Use, Environmental Management, and Community and Economic Development. Within these categories, the GreenStep Cities program identifies 28 best practices and over 160 actions that promote sustainability, including many that are directed toward reducing GHG emissions.

The GreenStep Cities best practices overlap with many of the best practices in the Sustainability Guide Plan. GreenStep Cities does have a number of best practices that can help the City meet community-wide GHG reduction goals, and that are not described in the Guide Plan. Actions that the City can consider are organized into categories, best practices, and specific actions, as shown in the example below.

GreenStep Cities - Categories, Best Practices, Actions

Best Practice Categories

1. Buildings and Lighting
2. Land Use
3. Transportation
4. Environmental Management
5. Economic and Community Development

Best Practices - Transportation

BP #11. *Complete Green Streets:* Create a network of multimodal green streets.
BP #12. *Mobility Options:* Promote active living and alternatives to single-occupancy car travel.
BP #13. *Efficient City Fleets:* Implement a city fleet investment, operations and maintenance plan.
BP #14. *Demand-Side Travel Planning:* Use Travel Demand Management and Transit-Oriented Design.

Complete Street Actions

Action 1) *Adopt a complete streets policy* that addresses street trees and stormwater, and modify street standards accordingly.
Action (2) *Adopt zoning language* for a selected area/project that is substantially equivalent to the LEED for Neighborhood Development credits for Walkable Streets or Street Network.
Action (3) *Document the installation* of trees, and green stormwater infrastructure, and utility renovations as needed (sewer, water, electric, telecommunications) as part of at least one complete street reconstruction project.
Action (4) *Identify and remedy non-complete street segments* by, for example, adding a bike lane or sidewalk.
Action (5) *Identify and remedy street-trail gaps* (at least one) between city streets and trails/bike trails to better facilitate walking and biking.
Action (6) *Implement traffic calming measures* in at least one street redevelopment project.

The GreenStep Cities program is a voluntary program administered by the Minnesota Pollution Control Agency and a collaborative association of non-governmental organizations. Technical assistance is available through the program for guidance in using the best practices and adapting then to the City's situation and goals.

Appendix A

Burnsville Greenhouse Gas Inventory

November 2010

CR Planning, Inc. and Michael Orange Consulting

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1.0. Introduction

1.1. Background

In May 2010, the City began a process of identifying a GHG assessment protocol and identifying criteria for setting reduction goals and strategy priorities. The inventory development process followed the ICLEI-Local Governments for Sustainability program protocols. Following the ICLEI protocols will allow the City to more easily join ICLEI in future years. The City's Sustainability Team set draft reduction goals and strategy priorities for consideration and adoption by the City Council.

The Inventory presents four estimates of the greenhouse gas (GHG) emissions:

1. 2005 emissions from City operations;
2. 2009 emissions from City operations;
3. 2005 community-wide (public and private sector) emissions;
4. 2009 community-wide emissions.

The community-wide estimates show the emissions from the entire community including activities of residents, businesses, and visitors within the City's geographical boundaries. The Inventory thus allows the City to set a baseline year (2005) and to measure initial progress in reducing emissions for both City operations and community-wide emissions.

Measuring is essential: As described by Osborne and Gaebler in their book, *Reinventing Government* (1992), "If you don't measure results, you can't tell success from failure. If you can't see success, you can't reward it. If you can't see failure, you can't correct it." Completing the GHG inventory allows Burnsville to set reduction goals and measure success or failure in meeting those goals. The Inventory must be transparent and able to be replicated, updated, and compared with other similar baseline assessments. It includes all pertinent and available data for the two study years chosen by City staff: 2005 and 2009.

1.2. Benefits of Measurement

GHG emissions offer a unique way to compare the effectiveness of various energy and sustainability choices and their related costs. GHG emissions serve as a common denominator for the comparison of kilowatts, therms, and gallons of gas consumed; vehicle miles traveled; tons of waste processed; gallons of potable water produced; and dollars invested. Taking inventory of the GHG emissions at the city operational and community level provides the City a number of benefits:

- Identify the City's opportunities to mitigate climate change and manage risk.
- Assist in promoting public understanding of the City's effects on climate change.
- Set the stage for a broader sustainability effort. Implementing sustainability strategies will assist the City in meeting the guidelines for Minnesota's GreenStep Cities Program.
- Provide a benchmark for comparison with future baseline assessments and for estimating the effectiveness of energy efficiency and other sustainability measures at meeting GHG emission reduction goals.
- Improve the City's competitiveness for federal and state funding opportunities that are targeted to cities that have taken steps to measure and reduce their carbon footprints.
- Serve as a model for other Minnesota cities that will follow the City's example of environmental leadership.

Finally, the Inventory, emission reduction goals, and strategy priorities will help Burnsville contribute to meeting the State's energy efficiency and greenhouse gas reduction goals that are the heart of the Next Generation Energy Act.

1.3. The Minnesota Next Generation Energy Act of 2007[1]

Early in the 2007 legislative session, the Minnesota Legislature and Governor Pawlenty approved one of the nation's most environmentally progressive energy laws. The Next Generation Energy Act includes the following components:

- **Renewable Energy Standard, 25% by 2025:** The law required electric utilities produce at least 25% of their total energy from new, renewable sources—wind, solar, hydro, biomass—by the year 2025. The law required Xcel Energy, the state's largest utility, to reach 30% by 2020. Currently, about 5% of the state's power comes from renewable sources.
- **Global Warming Act, 80% by 2050:** The Legislature established nationally aggressive statewide greenhouse gas reduction goals (using 2005 as a baseline) of 15% by 2015, 30% by 2025, and 80% by 2050. Among other provisions, this legislation:
  - ✓ Transitions Minnesota electric utilities from energy efficiency spending goals to energy savings goals. The Demand Efficiency Act sets a savings goal of

[1] Source: http://www.nextstep.state.mn.us/res_detail.cfm?id=3970

1.5% annually (currently utility Conservation Improvement Programs for electricity and natural gas save about 0.5% annually), aiming to cut Minnesota's electricity and natural gas use by almost 25% by 2025.

- ✓ Sets a State policy of reducing per-capita use of fossil fuel by 15% by the year 2015 through increased reliance on energy efficiency and renewable energy alternatives.
- ✓ Sets a goal of 1,000 Energy Star Buildings or LEED buildings in Minnesota by 2010.
- ✓ Expands and strengthens Minnesota's commitment to the development of locally owned renewable energy projects.

2.0. Summary of GHG Inventory Results

The Inventory examines GHG emission from two perspectives; emissions from City-operations; and community-wide emissions (public and private sectors). Each perspective looks at four sources for GHG emissions: electricity use, natural gas consumption, transportation fuel use, and waste management. The City operations inventory includes emissions from fuel consumption by emergency generators and transportation fuels used for employee commuting and business travel. The community-wide inventory is further sub-divided into the residential sector and the commercial and industrial sector.

Table 1 shows the GHG emissions for both community-wide sources and City-operations in 2005 and 2009. Table 1 shows total emissions and the emission rates on a per-capita basis and a per-full-time-equivalent (FTE) employee basis.

Table 1: Summary of Community-Wide and City-Operations GHG Emissions

	2005 (1)	2009	Percent Change
Community-Wide Emissions (tonnes)			
Energy:			
Electricity	459,353	399,252	-13%
Natural gas	435,990	368,624	-15%
Subtotal CO2e emissions	895,343	767,876	-14%
Transportation	360,510	340,214	-5%
Waste	9,110	7,655	-16%
CO2e emissions total	**1,264,964**	**1,115,746**	**-12%**
Per-capita CO2e	**20.6**	**18.3**	**-11%**
Weather-normalized CO2e	1,289,041	1,071,019	-17%
City-Operations Emissions (tonnes)			
Buildings and facilities	5,092	6,441	26%
Streetlights	1,540	1,572	2%
Signals and flashers	345	141	-59%
Water Utility	11,957	11,822	-1%
Transportation	3,143	3,201	3%
Waste	320	310	-3%
CO2e emissions total	**22,396**	**23,487**	**5%**
Per-FTE CO2e	77	85	10%
(1) Community-wide Xcel Energy data, which represents about 20% of the total consumption, was for 2006 and 2009. Community-wide CenterPoint Energy data is for 2007 and 2009. City-operations data from both utilities is for 2005 and 2009.			

2.1. Summary of the Community-Wide Analysis

The sources of community-wide GHG emissions are described below.

Energy (electric and gas): Electricity consumption for the residential sector and the commercial and industrial sector in 2009 was 2% lower than in 2005 and the associated GHG emissions were 13% lower. However, in order to properly compare the two years, the results must be adjusted for weather differences between the two years. Summer months were about 30% hotter in 2009 than in 2005. After weather-normalizing the data, electric consumption for 2009 was actually 2% higher than in 2005.

Weather changes create a similar situation when evaluating natural gas usage and associated GHG emissions. Gas consumption was 15% lower in 2009 than in 2006.[2] Accounting for temperature and the fact of 12% more heating degree-days in 2009 compared to 2005, 2009 consumption was actually 22% lower than in 2005.

GHG emissions, however, changed at a somewhat different rate than energy consumption. Looking at just the gas and electric energy data, GHG emissions for both the residential and the commercial and industrial sectors were 14% lower in 2009 than in 2005. After

[2] CenterPoint Energy provided data for 2006 and 2009.

normalizing for weather, the decline was 21% (prior to incorporating transportation and waste related emissions).

Transportation: Car and truck use, or vehicle miles traveled (VMT), account for most of the community's transportation-related GHG emissions (97%), with the City's share of the emissions associated with operations at the Minneapolis-St. Paul International (MSP) Airport and for river and rail operations accounting for the remaining 3% of emissions. VMT within the City from 2001 to 2009 averaged at about 583 million miles annually. VMT and associated GHG emissions have been declining since 2004, with a corresponding 5% decrease in GHG emissions.

Waste Management: Waste-related GHG emissions, which result when municipal solid waste is incinerated or landfilled and during the treatment of sanitary sewer discharges, comprise less than 1% of the total for the City.

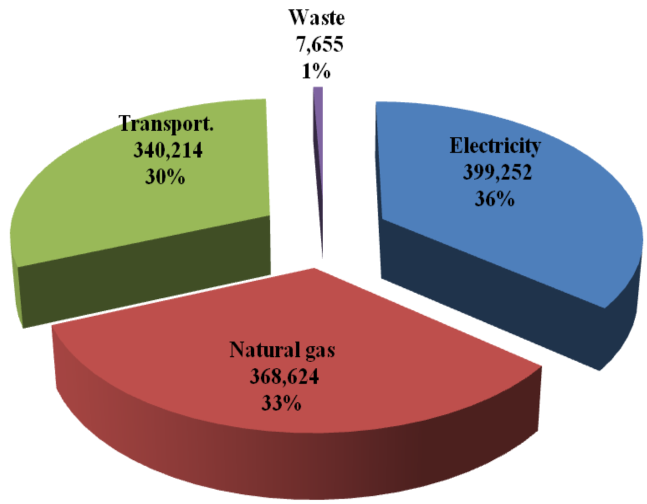
Combined Emissions: Overall, community-wide GHG emissions were 12% lower in 2009 than in 2005 and per-capita emissions were 11% lower. Figure 1 illustrates the percentage share of the total community GHG emissions in 2009 broken out by the 3 main fuels—electricity, natural gas, and transportation fuels—and for waste management.

Several factors explain the reduction in GHG emissions between 2005 and 2009:

- ✓ ***Economic downturn***. The recent economic downturn translated into reduced business hours, employment, and energy use associated with economic activities such as lighting, air conditioning, and heating. Economic pressure would also increase the incentive for energy conservation. Vehicle use would also be affected by the economic downturn.
- ✓ ***Reduced utility emission factors***. Two of the three utilities that provide electrical power to the City reduced their CO_2 emission factors significantly between 2005 and 2009. As such, a megawatt-hour (MWh) consumed in 2009 produced a smaller amount of CO_2 than in 2005. The reduced CO_2 emission factors translated the 2% increase in weather-normalized electricity consumption into a 13% decrease in GHG emissions.
- ✓ ***More efficient vehicles***. As older cars are replaced by newer cars, the overall gasoline efficiency increases and the emissions associated with each mile of vehicle travel decline.

Comparison with Other Cities: In a comparison with recent baseline assessment for three other cities in the region (Minneapolis, Falcon Heights, and St. Louis Park), the City's 18.3-tonnes-per-capita rate for 2009 was the highest of the four cities. Two factors account for Burnsville's low rank. First, the City has the highest per-capita rate for natural gas consumption at more than twice the average for the other three cities. Second, the City's VMT per-capita rate is the highest at 28% above the average for the other three cities. Burnsville has developed at a significantly lower density, making alternatives to single occupancy vehicles more difficult to use and increasing the length of trips for Burnsville residents. The other three cities also are much closer to the central city job centers and have better alternatives to automobile use.

Figure 1: Community Greenhouse Gases by Source, 2009 (tonnes)



Sensitivity Analysis: The sensitivity analysis examined likely and worst case margins of error for the community-wide analysis and concluded that the likely margin of error is about ±4%, a number well within the range of acceptability.

2.2. Summary of the City Analysis

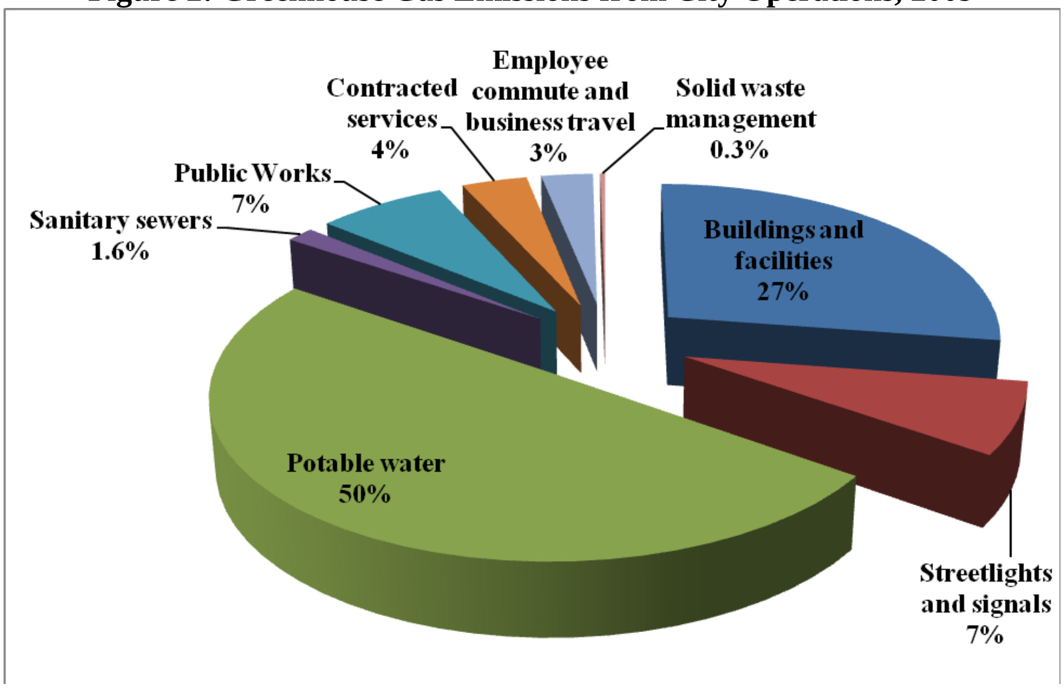
The summary of energy and GHG emissions for City operations is shown below, by category of operation.

- ***Buildings and facilities*:** Electricity consumption in City buildings and facilities was 36% higher in 2009 as compared to 2005. Accounting for the cooler summer in 2009 (35% cooler), the weather-normalized change increases to 52%. Natural gas consumption was also 36% higher in 2009 than in 2005. Accounting for the colder winter in 2009 (12% colder) brings the increase down to 25% in 2009. GHG emissions associated with building and facility energy use in 2009 (including electricity, diesel-powered emergency generators, and natural gas) were 26% higher than in 2005. The primary reason for the increase in 2009 is the new buildings; Performing Arts Center, the Heart of the City parking ramp, and other uses that were not open in 2005. When the figures are normalized to account for weather differences and to exclude new uses from the 2009 base, GHG emissions are actually 5% lower in 2009 than in 2005. Electricity usage declined by 6%, and natural gas use by 7%, between 2005 and 2009 for those buildings and facilities were in use in 2005 and 2009.
- ***Streetlights, Signals, and Flashers:*** While electricity consumption for streetlights stayed stable between the two study years, the City's program to replace its signals and flashers with high-efficiency LED fixtures resulted in a marked reduction in GHG emissions in 2009 (205 tonnes, 59% reduction) for this category of City operations.

- ***Water Utility***: The wells, pumps, and the water treatment plant necessary to supply the almost 3 billion gallons of annual potable water demanded by community residents and businesses are by far the largest source of GHG emissions, accounting for more than half of City operations' total GHG emissions. Unlike other City operations, energy use and GHG emissions are a direct consequence of the amount of water used by residents and businesses. Water utility electricity consumption increased by 25% between 2005 and 2009 and the related GHG emissions increased by 3% (due to the utility's lower emission factors). Much of the increase is attributable to the treatment plant expansion and a new contract to sell water to the City of Savage (both on line in mid-2009). Excluding new sources, energy consumption was 9% higher in 2009 than 2005 and GHG emissions were 10% lower. Natural gas consumption is small by comparison and was significantly lower in 2009 (by 61%). The City's sanitary system of pumps and lift stations generate only 1% of City operations' total GHG emissions.
- ***Transportation, employee commute, and business travel***: Total GHG emissions related to Public Works and contractor services were slightly higher in 2009 than in 2005, a 4% increase. The City's use of an alternative fuel, E85, for some of the City fleet generated 62 fewer tonnes of CO2 than if the vehicles had used gasoline. The estimate of the GHG emissions associated with employee commutes and business travel comprises only 3% of the City's emissions.
- ***Waste:*** The GHG emissions associated with treating the solid waste generated by City operations and the treatment of the sanitary sewer discharges from the City's system comprise about 1% of the total emissions from City operations.

Combined: GHG emissions associated with City operations were 5% greater in 2009 as in 2005. City GHG emissions equal about 2% of the community-wide emissions. Figure 2 provides a percentage breakout by category for 2009.

Figure 2: Greenhouse Gas Emissions from City Operations, 2009



3.0. Inventory Design

3.1. Inventory Tasks

Based on the above-stated Inventory goal, the City and Consultant defined the non-administrative tasks listed below for the 2 study years, 2005 and 2009:

Table 2: Inventory Tasks

1.0	**Community Analysis:**
1.1	On behalf of the City, Consultant requests community-wide energy-consumption data and emission factors from utilities that serve the City. Consultant compiles and evaluates data, identifies change factors, and calculates GHG emissions.
1.2	Consultant obtains data from MNDOT regarding VMT, compiles and evaluates data, and estimates GHG emissions.
1.3	Consultant estimates GHG emissions associated with the City's share of MSP airport use.
1.4	Consultant estimates GHG emissions associated with rail operations.
1.5	Consultant estimates GHG emissions associated with Minnesota River-based shipping.
1.6	Consultant estimates a) tons of waste generated, b) waste processing percentages (incinerated, landfilled [with and without methane recovery], composted and recycled). Consultant estimates associated with waste management.
1.7	City provides water production figures and Consultant estimates GHG emissions associated with treating sanitary sewer discharges.
2.0	**City Government Analysis:**
2.1	City provides energy use data for facilities owned and leased for City operations (annual usage data for study years for electricity, natural gas, and other fuels). Consultant compiles and evaluates data, estimates associated GHG emissions, identifies change factors, and analyzes trends.
2.2	On behalf of City, Consultant requests utilities for electricity use data for streetlights, signals, flashers, and other public utility facilities. Consultant will calculate the GHG emissions.
2.3	City provides Consultant with potable water distribution data (gallons produced, purchased, processed, and distributed). Consultant estimates associated GHG emissions.
2.4	City provides transportation fuel usage data by fuel type for City transportation activities. City provides fuel consumption information regarding contracted services. Consultant calculates GHG emissions.
2.5	City provides commuting data for City employees and FTE data (FTE and part-time employee data with associated vehicle type and typical commute distance). Consultant calculates VMT and GHG emissions. City provides business travel data for City employees (VMT by mode and vehicle type). Consultant calculates GHG emissions.
2.6	Consultant calculates associated GHG emissions. Consultant estimates waste generation associated with City operations using per-FTE data from Dakota County.

3.2. Estimation Methodology and Operational Boundaries

To estimate GHG emissions, this Inventory relies primarily on the *International Local Government Greenhouse Gas Emissions Analysis Protocol* (Protocol)[3] produced by the United Nations organization, ICLEI— Local Governments for Sustainability (ICLEI),[4] and The Climate Registry.[5] The Protocol provides guidance and emission factors essential for

[3] Refer to http://www.iclei.org/index.php?id=8154.

[4] According to its website, ICLEI is an international association of local governments as well as national and regional local government organizations that have made a commitment to sustainable development.

[5] According to its website, The Climate Registry is a nonprofit organization that provides meaningful information to reduce greenhouse gas emissions. The Climate Registry establishes consistent, transparent standards throughout North America for businesses and governments to calculate, verify, and publicly report their carbon footprints in a single, unified registry.

estimating GHG emissions produced by energy use, fugitive GHG emissions, and solid waste disposal.

The operational boundary of the community-wide part of this Inventory includes all of the major sources of GHG emissions within the City. The Protocol allows the exclusion of emission source categories that do not meet a *de minimis* threshold, such as those that together would represent less than 5% of the Inventory total. This Inventory includes the following categories that do not meet this 5% de minimis threshold: The City's share of the MSP Airport emissions, emissions associated with rail and river transportation, and emissions associated with the management of municipal solid waste and sanitary sewer discharges. Although small contributors, the inclusion of these emission sources increases the comprehensiveness of the analysis and confirms that these sources are, in fact, minor contributors. The City-operations part of the Inventory includes all of the emission sources normally included in a local government analysis.

3.3. Metric Tons Carbon Equivalents, Terms, and Source Documentation

The greenhouse gases of carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4) are aggregated and reported as carbon dioxide equivalents, a commonly used unit that combines greenhouse gases of differing impact on the earth's climate into one weighted unit. Consistent with the recommendation from ICLEI, carbon dioxide equivalents (CO_2e) are expressed in metric tons (tonnes), which equal 1,000 kilograms, or 2,204.6 pounds.

The source information for the tables and charts included in the body of the report can be found in the detailed tables included in the attachments. City staff are the source for data that pertains to City operations unless otherwise noted. All of the sources of data for the Inventory are transparent, fully identified, verifiable, and reliable. They consist of City records and staff reports; utility records and reports to the Minnesota Public Utilities Commission; internationally recognized methodologies and published scientific papers regarding the calculation of GHG emissions; federal, state, and county agencies (USDOT, USEPA, MNDOT, MPCA, Metropolitan Council, Metropolitan Airports Commission, Dakota County); data from the Canadian Pacific and the Union Pacific and C&NW railroads; river operations data from barge companies and the Army Corps of Engineers, and other published sources.

4.0. GHG Emissions from Community-Wide Electricity and Natural Gas Consumption (Task 1.1)

Most of the electricity and natural gas consumption goes to heat, light, air condition, and power our buildings. This Inventory shows breakouts of community energy three ways for the 2 study years. Table 1 in the summary section shows energy consumption by fuel type (electricity and natural gas) for the community and the associated GHG emissions broken out by the two key sectors, the residential sector and the commercial and industrial sector. Table 3 below shows the GHG emissions associated with gas and electricity consumption combined. Attachment 1 provides additional detail by showing the change since 2005 and listing a brief description of the likely factors contributing to the changes.

4.1. Electricity

To serve the City's electricity needs, the following four utilities distribute electricity within the City and all but Dakota Electric Association generate the power they distribute:

- **Dakota Electric Association:** The Dakota Electric Association (DEA)[6] serves the majority of the City. DEA purchases wholesale electricity from Great River Energy, a generation and transmission cooperative in Maple Grove, Minn., and distributes electricity to homes, businesses and farms in parts of Dakota, Goodhue, Scott and Rice counties.
- **Xcel Energy:** Xcel Energy[7] distributes electricity in small portions in the north of the City. The company's local generation subsidiary, Northern States Power, generates the electricity. Xcel Energy provided data for 2006 and 2009.
- **Minnesota Valley Electric Cooperative:** The Minnesota Valley Electric Cooperative (MVEC)[8] distributes electricity to the northwest portion of the City. MVEC is a distribution cooperative that purchases wholesale power from two generation and transmission cooperatives, Great River Energy and Basin Electric Power Cooperative. MVEC provided data for 2005 and 2009.
- **Great River Energy:** According to its website, Great River Energy is a "not-for-profit electric cooperative owned by its 28 member cooperatives. We generate and transmit electricity for those members, located in the outer-ring suburbs of the Twin Cities up to the Arrowhead region of Minnesota and down to the farmland region in the southwestern portion of the state."[9] GRE provided data for 2005 and 2009.

The GHG emissions associated with electricity generation varies over time according to a variety of factors, most importantly type of generating facility, fuel mix, and percent of renewable and nuclear generation. In addition, utilities purchase electricity from other generators, which can have very different GHG emission rates. As such, the calculation of GHG emissions depends on both the consumption data (in MWh) from the above four utilities that distribute power and the specific emission factors for the three electric generation utilities for the 2 study years.

Attachment 2 shows that electricity consumption combined for the residential sector and the commercial and industrial sector was 2% lower in 2009 than in 2005 and the associated GHG emissions were 13% lower. The difference between change in consumption and change in emissions is explained by three factors:

- **Weather effects consumption:** The number of seasonal cooling degree-days (SCDD)[10] in 2009 was very close to the 118-year average for the Twin Cities (refer

[6] According to the company's website, "Dakota Electric Association is a member-owned, not-for-profit electric utility founded by local farmers in 1937 with the help of the Rural Electrification Administration. With more than 100,000 members, Dakota Electric is the second largest electric cooperative in Minnesota and ranked among the 25 largest electric distribution cooperatives in the nation." https://www.dakotaelectric.com/

[7] http://www.xcelenergy.com/Minnesota/Company/Pages/Home.aspx

[8] http://www.mvec.net/

[9] http://www.greatriverenergy.com/aboutus/whoweare/

[10] Normalized Standard Heating/Cooling Degree Days predicts the energy consumption based on the 118-year average SHDD/SCDD, not the actual amounts. For normalization purposes, air conditioning (a weather-dependent use) is assumed to be

to Attachment 6). Electricity data from the three suppliers cover 2005, 2006, and 2009. Since the number of SCDD in 2005 and 2006 was higher than in 2009 by about 30%, electricity consumption would be expected to rise because air conditioning accounts for a significant portion of electrical use in buildings (up to 30%). However, when electricity consumption is normalized for the differences in weather, consumption for 2009 was only 2% higher than for 2005 (Attachment 2). The second factor helps explain this possible anomaly.

- **The economy effects consumption:** The economic downturn, the so-called "Great Recession" which began in early 2008, continues to have a significant dampening effect on commerce and people's pocketbooks. This translated into reduced business hours, reduced lighting and air conditioning consumption, and increased electricity conservation generally. The sector split on consumption changes is also revealing. In spite of the 30% increase in cooling degree days and greater demand for air conditioning, residential consumption *decreased* by 3% in 2009. The 5% increase in consumption by the commercial and industrial sector results in the blended increase of 2% mentioned above (Attachment 2). Were it not for the economic downturn, consumption figures would have been significantly higher.
- **CO_2 emission factors effect emissions:** Two of the three utilities that provide electrical power to the City reduced their CO_2 emission factors significantly since 2005, by a blended rate of 9% (Attachment 5).[11] As such, a MWh of electricity consumed in 2009 produced a smaller amount of CO_2 than in 2005. The reduced CO_2 emissions factors translated the 2% increase in weather-normalized consumption into a 13% decrease in GHG emissions.

4.2. Natural Gas

Calculating the GHG emissions associated with natural gas consumption is much more straightforward because of the relative consistency of the characteristics of natural gas, distributed by CenterPoint Energy, and its combustion. Multiplying consumption data (in decatherms, Dth) by the standard emission factor yields GHG emissions. Consumption and the associated GHG emissions were 15% lower in 2005 than in 2006.[12] Since the number of seasonal cooling degree-days in 2009 were 18% higher than in 2006, increased consumption would be expected under unchanged conditions. However, when normalized for weather, consumption in 2009 was actually 22% less than in 2006. As with electricity, the economic downturn translated into reduced business hours and increased conservation generally.

4.3. Sector Analysis

Attachment 2 shows that when the energy data is combined, GHG emissions for both the residential and the commercial and industrial sectors were 14% lower in 2009 than in 2005. However, when normalized for weather, the gap increased to an overall decline of 21%,

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25% of total electricity consumption. Heating buildings is assumed to be 80% of total natural gas use. Weather normalizing also corrects for using 2006 Xcel Energy data was for 2006 rather than the 2005 study year as was the case for the other two generators.

[11] For example, NSP Minnesota completed its Metropolitan Emission Reduction Project that replaced the coal-burning plants at its High Bridge and Riverside facilities with much more efficient natural gas plants. Also, the company increased its purchases of both wind and hydroelectric power, neither of which generate CO_2 emissions when producing power.

[12] CenterPoint Energy provided data for 2006 and 2009.

which was comprised of an 8% *decrease* in the residential sector and a 19% *increase* in the commercial and industrial sector.

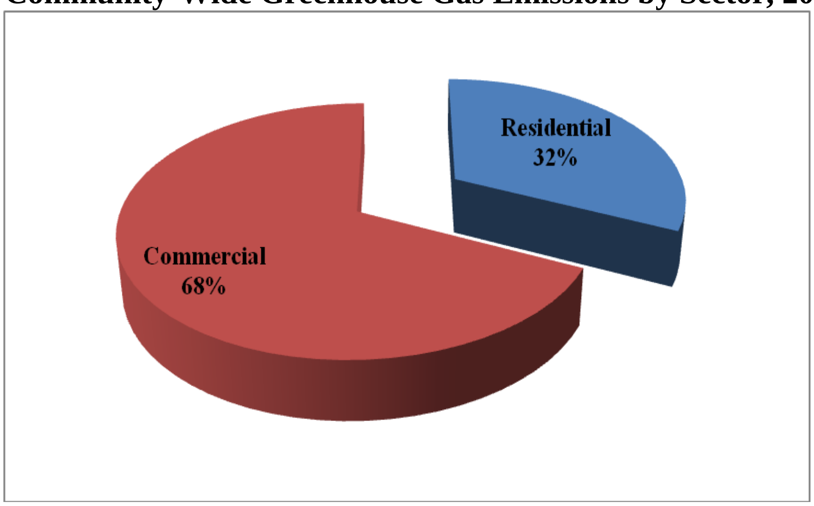
Table 3 groups the GHG emissions associated with community-wide electricity and natural gas consumption by the two sectors—residential, and commercial and industrial. The last row shows the GHG emissions on a per-capita basis. The figures for 2009 are substantially lower than for 2005 for the reasons described above.

Table 3: Greenhouse Gas Emissions from Community-Wide Energy Consumption (tonnes)

Sector	2005	2009	Change from 2005	Percent Change
Residential	268,675	245,365	(23,310)	-9%
Commercial & industrial	626,668	522,511	(104,157)	-17%
Total	895,343	767,876	(127,467)	-14%
Weather-normalized total	919,420	723,150	(196,270)	-21%
Per-capita	14.6	13.0	(1.6)	-11%

Figure 2 illustrates that 68% of the community's GHG emissions from electricity and natural gas usage stems from the commercial sector and 32% from the residential sector in 2009.

Figure 3: Community-Wide Greenhouse Gas Emissions by Sector, 2009



5.0. GHG Emissions from Community-Wide Transportation

Table 4 provides an overview of the respective GHG shares from the four transportation components—vehicle miles traveled (VMT), airport emissions, railroad, and river-related sources. Emissions related to VMT dominate the transportation category and account for 97% of the total while emissions associated with airport, railroad, and river operations constitute the remaining 3%. Overall, the transportation uses account for about 30% of the total emissions in the City (Attachment 1). GHG emissions associated with transportation uses were slightly lower in 2009 than in 2005. Most of the decrease, 80%, is attributable to reduced VMT and another 19% to decreased airport emissions, both of which are primarily due to the economic recession.

Table 4: Greenhouse Gas Emissions from Transportation

	2005		2009		GHG Change from 2005		
Transportation Mode	**GHG (tonnes)**	**% of Total GHG**	**GHG (tonnes)**	**% of Total GHG**	**GHG (tonnes)**	**% Change**	**% of Total Change**
VMT	345,977	96.0%	329,322	96.8%	(16,655)	-4.8%	82%
MSP Airport share	13,716	3.8%	10,251	3.0%	(3,466)	-25.3%	17%
Rail	611	0.2%	450	0.1%	(161)	-26.4%	1%
River	206	0.06%	192	0.06%	(14)	-6.8%	0.1%
Total	360,510	100.0%	340,214	100.0%	(20,296)	-5.6%	100.0%
Per-capita GHG	6.1		5.7		(0.4)	-6.3%	

5.1. GHG Emissions from Vehicle Miles Traveled (Task 1.2)

Consistent with the usual protocol for estimating roadway-related emissions, this Inventory accounts for all vehicle trips—calculated as vehicle miles traveled (VMT)—that occurred within the City boundaries. Fortunately, The Minnesota Department of Transportation (MNDOT) has developed reliable data for total VMT for all Minnesota communities from 2001 to 2009.[13] Table 5 shows the VMT and per-capita VMT within the City boundaries from 2001 to 2009 plus the associated per-capita GHG emissions. Attachment 3 includes additional detail regarding this matter and all of the sources of information. Total VMT within the City from 2001 to 2009 averaged at about 583 million miles annually and varied over this period by about ±3%. VMT and associated GHG emissions have been declining since 2004.

To estimate the GHG emissions associated with VMT, this Inventory relies upon the GHG-per-VMT generation rates developed as part of the countywide carbon baseline assessment prepared by Dakota County.[14] Since population in the City is very stable, the range of GHG emissions on a per-capita basis matched this change. Figures 3 and 4 graph VMT and per-capita GHG emissions respectively and show the dashed trend lines, which are trending lower slightly. Figure 5, which shows per-capita GHG emissions associated with VMT, reflects this same trend.

[13] MNDOT traffic engineers use a variety of devices to collect traffic data including permanently installed loop detectors every half mile on metro area freeways, Automatic Traffic Recorders (ATRs) permanently installed in key locations throughout the state, and tube counts. The biggest share of the statewide counts comes from road tubes that are placed on the roadway for a 48-hour period. These counts are then adjusted to annual average daily traffic (AADT) by using factors that are derived from continuous counting sites. Historically, MNDOT has collected traffic data on all state roads on a two-year cycle, on all county state aid roads, county roads, and municipal state aid streets on a two or four-year cycle. Once MNDOT engineers obtain the AADT for each segment of roadway, they can compute VMT by multiplying the AADT by the segment length. To get an AADT estimate for a year that a road was not counted, engineers use growth factors that are derived from ATRs and from other roads that are counted that year. For lower level roads that are not counted, engineers estimate the traffic volume.

[14] The County relied on the Clean Air Climate Protection (CACP) software developed by ICLEI. The software combines the US Department of Transportation's "Mobile 5" computer program, which takes into account the national fleet mix and national rates of fuel consumption for a variety of transportation fuels, with the GHG emission factors by fuel type and VMT.

The declines in all of the figures from 2008 to 2009 are probably attributable primarily to the shrinking economy. Since the national fleet mix gets more efficient and cleaner each year, this is another factor that accounts for the steeper decline in per-capita GHG emissions

Table 5: Greenhouse Gas Emissions from Vehicle Miles Traveled

Year	Total VMT (millions)	GHG Emissions (tonnes)	Per-Capita GHG Emissions
2001	562.6	342,724	5.7
2002	579.5	348,968	5.7
2003	577.4	343,912	5.6
2004	593.9	350,140	5.7
2005	589.2	344,203	5.6
2006	587.5	340,067	5.6
2007	590.1	339,407	5.5
2008	587.0	335,725	5.5
2009	578.9	329,322	5.4

Figure 4: Vehicle Miles Traveled (millions), 2001 to 2009

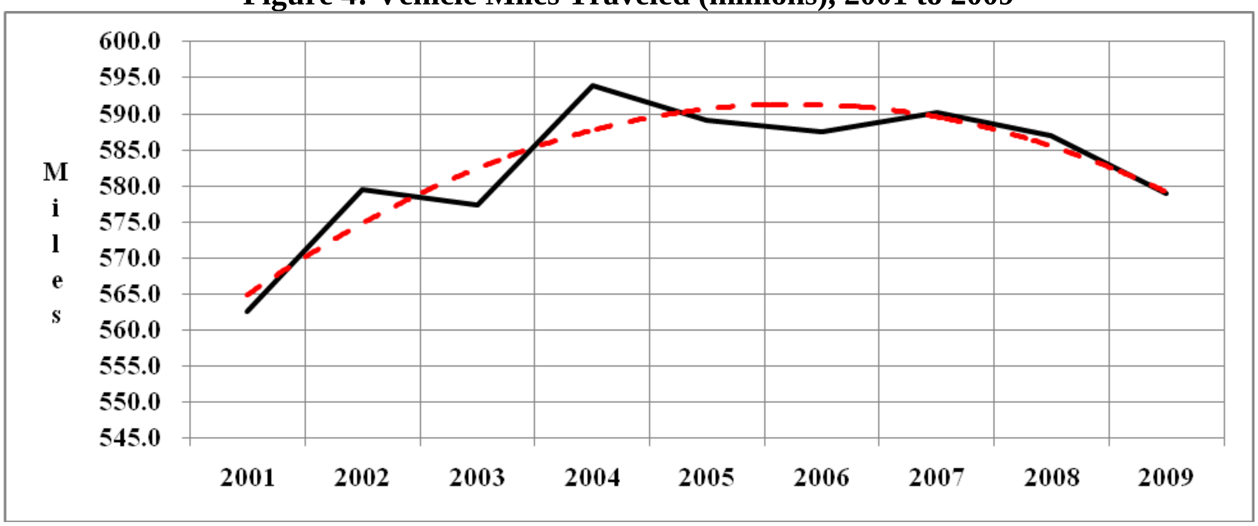


Figure 5: Per-Capita Vehicle Miles Traveled, 2001 to 2009

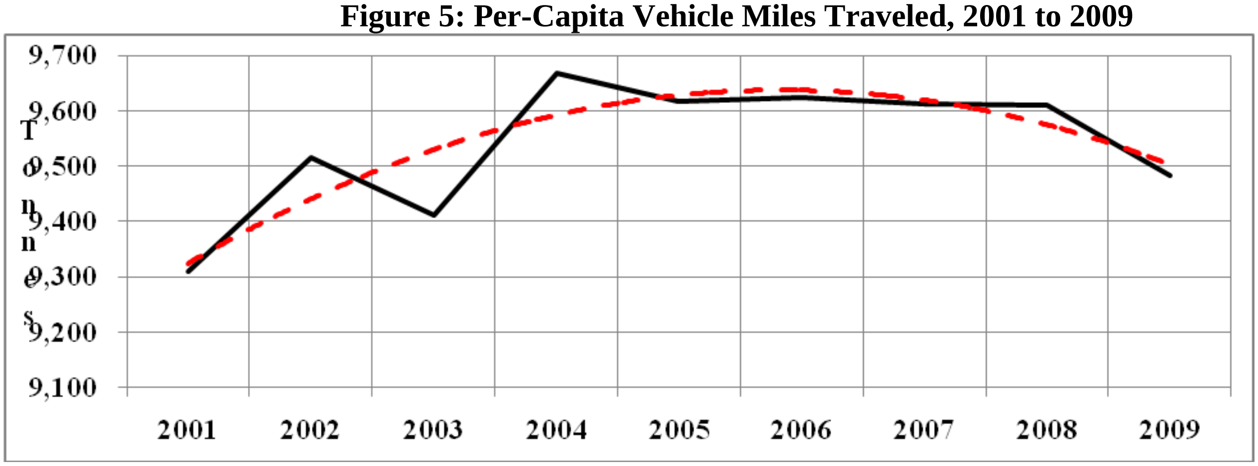
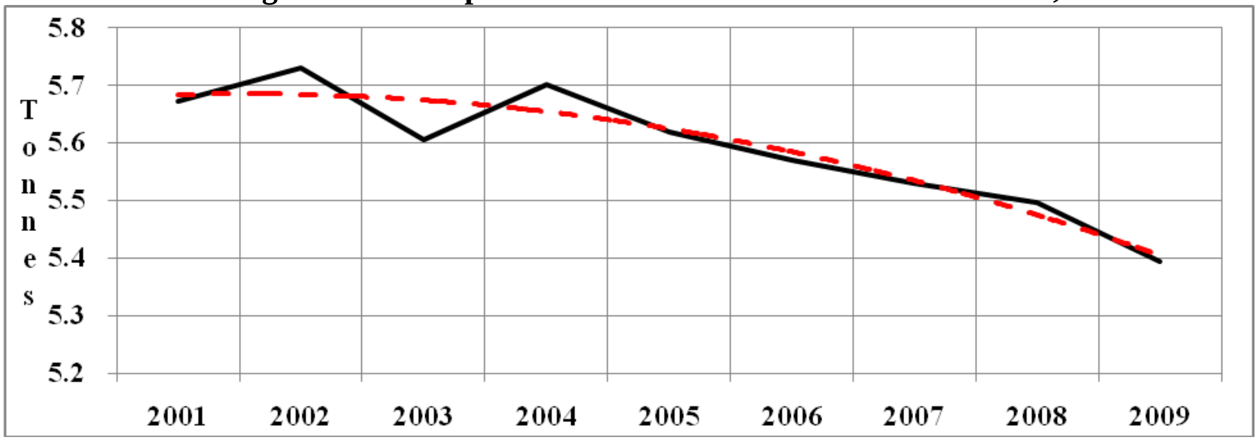


Figure 6: Per-Capita Greenhouse Gas Emissions from VMT, 2001 to 2009



5.2. City Share of GHG Emissions from the Minneapolis Saint Paul International Airport (Task 1.3)

Although the Minneapolis Saint Paul International (MSP) Airport is not located within the City, its operations are significant contributors to the region's GHG emissions. This Inventory accounts for the City's share of these emissions on a per-capita basis. As such, 2% of MSP emissions are attributable to the City to match its share of the region's population (Attachment 8).

At the direction of the Metropolitan Airports Commission (MAC), the local consulting firm, Wenck Associates, Inc., prepared a carbon footprint analysis for the MSP Airport titled, *Greenhouse Gas Report, Metropolitan Airports Commission, December 2008*. The report states that the focus of the study was "to calculate the annual CO_2 emissions from MAC-owned and controlled sources at MSP, with the geographic footprint defined as the MSP property. The analysis went on to determine the CO_2 emissions footprint for MSP as a whole, including the emissions from other sources located at MSP, namely the airlines and other tenants, and the general public's use of MSP."[15] The study defined the boundary of the analysis as MSP-owned property and the above-ground-level airspace up to 3,000 feet. Using this boundary definition, the 2005 and 2007 CO_2 footprints for emissions actually released at MSP Airport were determined to be 535,000 and 482,000 metric tons respectively.[16]

[15] From the MAC study: "The approach to calculating CO_2 emissions relies on methods and/or data published by the Intergovernmental Panel on Climate Change (IPCC), the United States Environmental Protection Agency (US EPA), the World Resource Institute (WRI), the World Business Council for Sustainable Development (WBCSD), the International Council for Local Environmental Initiatives (ICLEI), the Climate Registry, and the Minnesota Pollution Control Agency (MPCA)." This protocol was used to assess carbon emissions for Denver International Airport as well.

[16] The report states further: "The analysis went even further to quantify the overall aviation-related CO_2 emissions footprint, which added the emissions based on the fuel dispensed at MSP, but released outside the MSP airspace. . . . The main source of CO2 emissions associated with MSP is fuel combustion from aircraft above 3,000 feet AGL. Though these emissions actually occur away from MSP, such as happens with international flights around the world, they are identified as a method to account for the fuel dispensed at MSP and to account for the total CO2 footprint. . . . The emissions data reported for operations above 3000 feet AGL are beyond the realm of the Airport environment and are identified for informational purposes only."

Attachment 8 includes an estimate of what share of these total airport-related emissions are most appropriately attributable to the City. The first step was to estimate 2009 emissions from the airport data (which only included 2005 and 2007). Linear regression analysis and averaging produced reasonable results based on GHG emissions per type of aircraft operation. The extensive carbon footprint analysis prepared for the City and County of Denver also included the Denver International Airport and found that the City of Denver's share of the airport's 2006 emissions was approximately equal to Denver's share of the regional population.[17] Since the Denver metropolitan area is of comparable size to the Twin Cities metropolitan area, this Inventory assumes this same relationship applies here as well. As stated above, this Inventory accounts for the City's share of these emissions on a per-capita basis. Airport-related emissions constitute about 2.5% of transportation-related GHG emissions (Table 4).

5.3. GHG Emissions from Railroad Operations (Task 1.4)

Two railroads operate within the City: the Canadian Pacific, which includes the Soo Line and Milwaukee Road railroads, and the Union Pacific, which includes the Chicago and Northwestern Railroad. Attachment 9 provides the detail regarding the GHG emissions from these operations. The total constitutes only a sliver of the GHG emissions from transportation, approximately 0.2% (Table 4).

5.4. GHG Emissions from River Operations (Task 1.5)

Attachment 10 details the operations and associated GHG emissions for barge traffic on the Minnesota River. Resulting GHG emissions are halved because the City shares these emissions with its neighboring city on the north side of the river, Bloomington. Like railroad emissions, river-related GHG emissions are only a small part of the transportation sources, 0.06% (Table 4).

6.0. GHG Emissions from Waste Management (Task 1.6)

The City has an "open" policy for waste management and it licenses several haulers to collect waste materials in the City. The City does not compile comprehensive waste management data, but rather licensed haulers report collection data to Dakota County. Since haulers in an open system do not as a rule segregate data according to municipal boundaries, only county boundaries, it is not possible to disaggregate municipal data from the county totals.

Attachments 11 and 12 include an estimate of City collection amounts based on the assumption that, on a per-capita basis, collections in the City will be comparable to those elsewhere in the County. GHG emissions for municipal solid waste (MSW) depend on how the waste was managed. Attachment 11 includes GHG emission rates for the portions of the waste stream that were incinerated and land filled. No emissions are assumed for waste that is composted or recycled. These emission rates take into account the percent of methane recovery at landfills and waste composition (Attachment 13). GHG emissions associated with waste management constitute a very small percentage of the overall emission estimate, less than 1%.

[17] Source: *Greenhouse Gas Inventory for the City and County of Denver*, May 2007).

7.0. GHG Emissions Associated with the Treatment of Sanitary Sewer Waste (Task 1.7)

Attachment 21 includes date regarding water use in the City. Using winter consumption rates as a base, it includes an average monthly estimate of the portion of the water consumed that is drained into the City's sanitary sewer system. This way, summertime activities such as irrigation and outdoor washing of vehicles are excluded from the estimate. The GHG emissions associated with the treatment of sanitary sewer waste represents a tiny fraction of the City's overall emissions (0.02%).

8.0. Community-Wide Totals and Comparisons with Other Cities

GHG emissions totaled to about 1.3 million tonnes in 2009, an amount that was 12% lower than in 2005. Since population did not change substantively, per-capita GHG rates were 11% lower in 2009 compared to 2005; 20.6 tonnes per capita in 2008 and 18.3 tonnes in 2009. Normalizing for weather accounts not only for the weather variations between study years but also addresses the fact that the two utilities that could not provide data for the 2005 study year (2006 data for Xcel Energy and 2007 data for CenterPoint Energy). When energy use is normalized for weather differences, total emissions for both study years were slightly higher but the difference shrank slightly. The primary causes for the decreases are likely the shrinking economy and the other factors mentioned above (refer to the listing of the reasons on Attachment 1).

Attachment 22 compares the key data for the City with baseline assessments prepared recently for three other metro cities, Minneapolis, Falcon Heights, and St. Louis Park. At 18.3 tonnes per-capita in 2009, the City has the highest rate among the four cities. Two factors are important:

- **Natural gas:** The City has the highest per-capita rate for natural gas consumption; in fact, at 111 Dth per capita, it is more than twice the average for the other three cities, which have an average of 48 Dth per-capita.
- **VMT:** The City's VMT per-capita rate is the highest, 28% above the average for the other three cities. When focusing on freeway VMT, the City has nearly twice the average of the other three cities. Even at the level of local streets, the City has the highest per-capita rate, 38% above the average of the other three cities. These figures reflect the effects of low-density development on VMT because the other three cities are more densely populated and, due to their close proximity to the central city job centers, have better alternatives to the automobile.

Attachment 27 includes the land use map for the City.

9.0. City Operations: Introduction

This part of the Inventory examines GHG emissions associated with City buildings and facilities; streetlights, signals, and flashers; potable water production and distribution; sanitary sewer discharge treatment; transportation sources including those from Public Works and contractor services, employee commutes, and business travel; and waste management for City operations.

The City has numerous buildings, parks, wells, pumps, streetlights and signals that consume electricity and natural gas. The City's accounting and facility management staff must deal with 206 electricity accounts with 3 companies, 36 natural gas accounts with CenterPoint Energy, and a diesel fuel account for emergency generators; a total of 243 accounts. Of course, most facilities have multiple accounts. Attachments 15 and 16 provide detailed energy consumption data for all of the City's buildings and facilities. Since three different electrical generation utilities supply power to City facilities, the GHG emissions were generated using the emission factors unique to each utility for each of the 243 accounts. Attachment 14 consolidates the data and Attachment 24 normalizes the data for differences in weather conditions and the availability of uses between the two study years.

Table 6 provides a summary of the associated GHG emissions.

Table 6: Greenhouse Gas Emissions from City Operations, 2009

Source	Electricity	Natural Gas	Liquid Fuels	Waste Management	Total	% of Total
Buildings and facilities	5,315	1,103	11		6,441	27%
Streetlights and signals	1,724				1,724	7%
Potable water	11,441	262			11,703	50%
Sanitary sewers	119			246	119	2%
Public Works			1,682		1,682	7%
Contracted services			849		849	4%
Employee commute and business travel			670		670	3%
Waste management				64	64	0.3%
Total	**18,599**	**1,365**	**3,212**	**310**	**23,487**	**100%**

10.0. City Buildings and Facilities (Task 2.1)

This section of the Inventory focuses on energy consumption (electricity, natural gas, and diesel fuel for emergency generators) and the associated GHG emissions for City buildings and facilities. Attachment 1 shows that City buildings and facilities constituted about a quarter of the total GHG emissions from City operations (see also Figure 2). Attachment 14 provides detailed information regarding energy consumption and GHG emissions. The figures in the middle of the table show the subtotals for City buildings and facilities (which includes park, recreation, and other facilities plus associated on-site lighting and emergency generation).

10.1. Electricity consumption and GHG emissions

Electricity consumption was 36% higher in 2009 as compared to 2005. Two major reasons account for most of this apparent increase—new uses and weather. Attachment 17 lists several new uses that were not in existence in 2005 including the Performing Arts Center and the Heart of the City parking ramp that were not open in 2005. Attachment 24 takes this into account and includes a normalized 2009 base that excludes these new uses.[18] The result shows a 6% decline in electricity consumption. Attachment 24 also accounts for the second factor, weather, and the fact that cooling degree-days were 35% lower in 2009 than in 2005 (Attachment 1). In sum, what at first appeared to be a major increase in electrical consumption (36%), shrinks to only 4% when the numbers are normalized for new uses and weather.

[18] The goal here is to track change from 2005 to 2009 for only those facilities that were in place in 2005.

Attachment14 tallies the sources of GHG emissions for buildings and facilities, including the emergency power generators (which are detailed in Attachment 18). Attachment 24 includes this data and adds normalizing calculations for new uses and weather differences as described above. Before normalizing, the attachment shows that GHG emissions in 2009 were 25% higher than in 2005.[19] The attachment also shows that, when the base is adjusted to exclude the new uses, GHG emissions are actually 14% lower in 2009 as compared to 2005. When further normalized for milder-than-normal weather, the 2009 GHG emissions are 5% lower in 2009 than 2005.

10.2. Natural gas consumption and GHG emissions

There is a similar story for natural gas consumption. Attachment 24 shows that natural gas consumption, like electricity, was 36% higher in 2009 than in 2005. When accounting for a normalized base that excludes the new uses as described above, Attachment 24 shows consumption increased by 7%. However, seasonal heating degree-days were 12% higher in 2009 compared to 2005 (Attachment 1) so weather-normalized consumption of the 2009 base that excludes the new uses actually shows a 7% decrease in 2009.

As described above for electricity, Attachment 24 includes GHG emission data that are normalized to account for new uses and weather differences. Before normalization, GHG emissions were 36% higher in 2009 than in 2005.[20] After normalizing for both new uses and weather (seasonal heating degree-days were 12% higher in 2009 compared to 2005, Attachment 1), Attachment 24 shows that GHG emissions were 2% lower in 2009 than in 2005.

11.0. Streetlights, Signals, and Flashers (Task 2.2)

Attachment 14 provides the electricity consumption figures and associated GHG emissions for streetlights, signals, and flashers (Attachment 15 includes the details by account). While electricity consumption by streetlights stayed stable between the two study years, the City's program to replace its signals and flashers with high-efficiency LED fixtures resulted in a marked reduction in GHG emissions in 2009 (205 tonnes, 59% reduction). This category accounted for about 8% of the total GHG emissions from City operations (Attachment 1).

The City added a significant amount of new streetlights, signals, and flashers by 2009. Attachment 24 accounts for this and shows that, when normalized for these new uses, electricity consumption was 9% lower in 2009 compared to 2005 and the associated GHG emissions were 20% lower.

12.0. Water Utility (Task 2.3)

The wells, pumps, and the water treatment plant necessary to produce potable water are by far the largest consumer of energy and source of GHG emissions and they account for more than half of

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[19] Note that before normalizing, electricity consumption was 36% higher in 2009 than in 2005 but GHG emissions were only 25% higher. The difference is due to the lower GHG emission factors for electricity generation in 2009, which is explained in detail in Section 4.1.

[20] Unlike electricity generation, the GHG emission factor for natural gas is very stable so percentage changes between the study years for consumption and associated GHG emissions will match. The percentage changes under the "Normalized % Change (4)" column do not consistently follow this same match-up because the denominators vary in response to there being new natural gas uses only for the "Buildings" and the Water Utility" categories and not the other categories.

the GHG emissions from City operations (Attachment 1 and Figure 2). While electricity consumption increased significantly in 2009 (by 25%), the related GHG emissions only increased by 3% due to the above-mentioned decrease in utility emission factors. The City's water treatment plant expansion, which came on line in mid-2009, was the primary reason for the large increase in electricity consumption. Attachment 24 accounts for this and shows that when this new source is excluded, consumption was 9% higher in 2009 than 2005 and GHG emissions were 10% lower. Natural gas consumption, which is small by comparison, was significantly lower in 2009 (by 61%). Attachment 14 shows that the combined figure for GHG emissions from both fuel sources was 1% lower in 2009 than in 2005.

The City's system of pumps and lift stations for the sanitary sewer system result in a very small amount of GHG emissions, only 1% of the City's total emissions (Attachment 1).

13.0. City Transportation

City transportation includes the two sub-categories described below. Together, City transportation constitutes about 14% of the City emission total (Attachment 1 and Figure 2).

13.1. Public Works and Contracted Services (Task 2.4)

Attachment 19 provides a breakout of the factors needed to estimate the GHG emissions associated with Public Works operations and private contractors that perform tasks and complete construction projects that are the normal domain of the City. The table combines the City fuel consumption data by vehicle type (gas, diesel, and E85 gasohol) with the GHG emission factors for each fuel.

The City's contractors provided conversion factors that accounted for gallons per contract dollar and construction mile, and the fuel mix (diesel v. gasoline). Attachment 1 shows that GHG emissions that stem from fuel consumption by Public Works activities decreased by 4% in 2009 over 2005. The City's use of an alternative fuel, E85 (which emits 29% fewer GHG emissions than gasoline) for some of the City fleet generated 62 fewer tonnes of CO_2 than if the vehicles has used gasoline. Emissions from contractor activities increased by 22% in 2009. This category accounts for about 11% of the City's total GHG emissions (Attachment 1 and Figure 2).

13.2. Employee Commute and Business Travel (Task 2.5)

The City conducted a survey of employee commuting habits. Of the 277 current FTE employees, 86 completed the survey. Attachment 20 details how VMT was estimated for the respondents and then projected as a viable sample for the entire employee populations for 2009 and 2005. The survey took into account both normal and alternative modes of travel and the normal round-trip commuting distance. For part-time employees, the survey allocated a percentage of the round-trip distance based on whether the employee worked half time or less. The average estimate of 5,300 miles per employee annually compares with the analysis prepared by Dakota County in 2009 that found an average of 7,100 miles per County employee.

By estimating the annual VMT for the 86 employees who answered the survey out of the possible 277 FTE City employees, the sample results have a 95% confidence level with a confidence interval of 9. Put differently, the sample size was sufficiently large to assert with 95% statistical confidence that the annual VMT for all of the City employees will be within ±9% of the survey results.[21]

The attachment also lists the expected mileage for business travel including airline travel. Attachment 19 includes an estimate of the associated GHG emissions for employee commutes and business travels, which together equal about 3% of the total for the City (Attachment 1).

14.0. Waste (Task 2.6)

Attachment 22 includes an estimate of the MSW generated by City operations based on the assumption that a City job will generate MSW at a rate comparable to a job elsewhere in Dakota County. This approach yielded an estimate of slightly more than 1 ton of waste per FTE job in the City. Dakota County's analysis of the actual waste per County employee in 2009 was 0.24 tons per FTE employee. To be conservative, this analysis relies on the larger estimate.

Attachment 21 uses the City water production data to estimate a wintertime base that excludes water used for activities such as irrigation and at-home vehicle washing. This is the amount estimated to enter the City's sanitary sewer system. The GHG emissions associated with treating the sanitary sewer outflows, in combination with employee-generated waste equal a little over 1% of the City's total emissions (Attachment 1).

15.0. Total GHG Emissions from City Operations

GHG emissions associated with City operations were 5% higher in 2009 than in 2005, 22,400 tonnes in 2005 and 23,500 tonnes in 2009 (Attachment 1) for the reasons described above. Attachment 24 accounts for new uses and weather differences between the study years. If new uses are excluded from the analysis, GHG emissions are 11% lower in 2009 than in 2005. If also normalized for the milder weather in 2009, emissions are 10% lower than in 2005. Emissions associated with City operations equal about 2% of the community-wide emissions. This is typical for carbon baseline assessments.

16.0. Sensitivity Analysis

The community-wide and the City-operations analyses account for the GHG emissions associated with all of the major sources of energy consumption, uses of transportation fuels, and waste management methods that are normally included in carbon baseline assessments.[22]

As fully described in this Inventory and accompanying attachments, all of the sources of data for the Inventory are transparent, fully identified, verifiable, and reliable. They consist of City records and staff reports; utility records and reports to the Minnesota Public Utilities Commission;

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[21] Statistical calculations from this source: http://www.surveysystem.com/sscalc.htm

[22] The above description applies to the information scoped into the Inventory. Carbon inventories prepared for other cities vary somewhat regarding data included. For example, the inventory developed for the City of Denver accounted for the GHG emissions associated with concrete production for public works projects. Other inventories, in contrast, ignore solid waste, sanitary sewer treatment, railroads, river, and airport-related emissions.

internationally recognized methodologies and published scientific papers regarding the calculation of GHG emissions; federal, state, and county agencies (USDOT, US EPA, MNDOT, MPCA, Metropolitan Council, Metropolitan Airports Commission, Dakota County); data from the Canadian Pacific and the Union Pacific and C&NW railroads; river operations data from barge companies and the Army Corps of Engineers, and other published sources.

The data used to develop the Inventory were specific to the GHG emission categories for the City with one important exception.[23] To derive the community-wide GHG emissions from vehicle use, the Inventory relies on the USDOT Mobile 5 computer model and scientifically determined GHG emission factors to derive an annual ratio of GHG emissions per vehicle miles traveled nationally. The model relies on the national fleet mix and driving characteristics. Local fleet mix and driving habits could vary somewhat from the national average. For example, the state's fleet mix may be newer and thus more efficient than the national average because Minnesota's colder-than-average winters and reliance on road salt could combine with the state's higher-than-average household income to rust out and retire older, less-efficient vehicles faster. In this case, the national average would overestimate the City's emissions. On the other hand, this same colder climate results in less efficient vehicle operation in the winter than the national average, which may balance matters out. There is no comparable data set for the State of Minnesota or Dakota County with which to derive these important estimates for the City. As detailed in the transportation section of this report, the second part of the GHG calculation relies on the annual VMT calculations completed since 1988 by MNDOT engineers. This data set is very reliable and accurate.

Attachment 25 includes a sensitivity analysis that estimates the margin of error in the Inventory. It approaches the matter from two directions:

- **Worst-case scenario:** Since the GHG-per-VMT ratio accounts for a significant part of the total community-wide GHG calculation (30% in 2009), the sensitivity analysis first incorporated very high margins of error for all of the other major data sources in the community-wide analysis to determine the maximum allowable margin of error for the GHG-per-VMT ratio. The attachment's fourth column shows these figures. The conclusion was ±17%. In other words, even if all of the other major data sources are off the mark by very large margins, the GHG-per-VMT ratio could still be off by up to ±17% and still yield a final GHG estimate that was within the acceptable ±10% of the actual number. The attachments fifth column derives these figures. A margin of error greater than ±10% would be unacceptable.
- **Most likely case:** It is highly unlikely that all of the primary data sources have margins of error as calculated in the worst-case scenario. Rather, the data sources are extremely reliable and the variation between the national fleet mix and the local fleet mix will probably not be substantial. This more reasonable case yields a likely margin of error that is about ±4%, a number well within the range of acceptability. The attachment's last column derives these figures.

[23] The Inventory relies on a second non-local data source—waste management. However, the category accounts for a mere 0.3% of the total emissions so its margin of error is insignificant. Counties are the primary governmental keepers of waste management data. Since haulers generally report their collections based on county boundaries, not municipal ones, there is no complete data set specific to the City. As such, the GHG estimation for the City relies on the assumption that, on a per-capita basis, waste management within the City is comparable to that of the County as a whole.